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(71) Applicant: **HOWMEDICA INTERNATIONAL INC.**
Shannon Co. Clare (IE)

(72) Inventors:
- **Pichon, Denis**
  14112 Bieville-Beuville (FR)
- **Storer, John Andrew**
  14250 Jouaye Mondaye -Bayeux (FR)

(74) Representative: **Bridge-Butler, Alan James et al**
G.F. Redfern & Co.,
7 Staple Inn,
Holborn
London WC1V 7QF (GB)

(54) Apparatus for impacting bone chips in a bone canal

(57) Apparatus for impacting bone chips in a bone canal comprising an impactor having an impaction head of predetermined dimensions and a stem extending therefrom, and a visual indicator provided with means for secure location on said stem to visually indicate the distance of insertion of said impaction head within a bone canal.

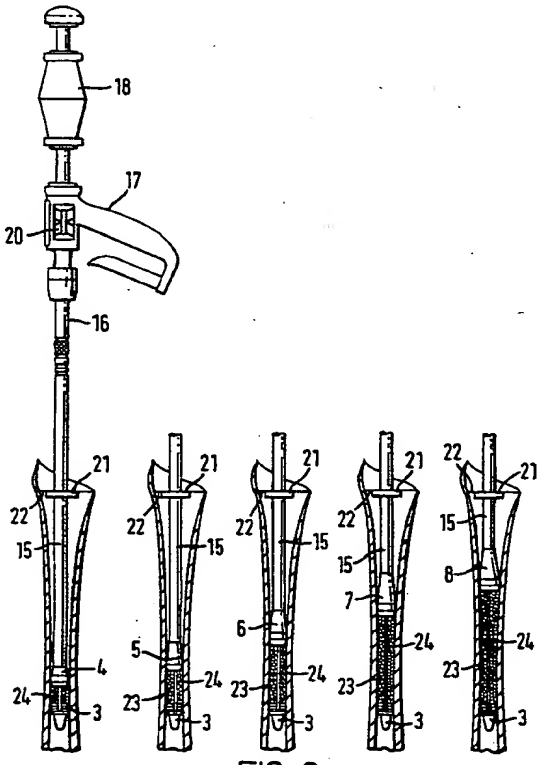

FIG. 2

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D scription

This invention relates to apparatus for establishing the various sizes of impactor to be used when impacting bone chips in the intramedullary canal of a femur into which the stem of a hip prosthesis is to be located.

The intramedullary canal at the proximal end of a femur is tapered and when a femoral hip prosthesis is to be fitted the stem is usually reamed out to accept it. In the technique of using bone chippings to surround and locate the stem the bone chippings have first to be impacted. Thus, impactors of different shape and diameter have to be used for different parts of the canal. As considerable force is applied to the bone chippings to establish them in place care must be taken to avoid damaging the walls of the intramedullary canal during the impaction technique.

Impactors comprise an impaction head and a stem which can be attached to an impaction tool but before chips are applied an intramedullary plug is usually passed down the canal to a desired depth. It is important to establish the distance above the bone plug and each size of impactor can be passed without jamming against the wall of the canal. Driving the impactors beyond this point runs the risk of splitting the femur. It is therefore necessary to cheque that the impactor which corresponds to one size smaller than the intramedullary plug can be passed over a guide wire down to the plug without obstruction then, taking each larger size impactor in turn, pass it over the wire and note the depth of insertion to which each will go before it jambs against the walls of the canal. This can be done by using an impaction tool which is provided with a gauge from which the depth of insertion can be noted. This reading of the appropriate distance above the plug can be noted for each size of impactor. Subsequently when impacting the bone chips the impactor must not be driven beyond the noted depth. The plug depth is read off a marked guide wire which extends into the handle of the impactor and can be read through an appropriate viewing window.

As mentioned above the impaction depth must be noted on a proforma which must then subsequently be consulted for each size of impactor.

The present invention is intended to provide apparatus which can be used in this way but which will be more simple to operate and will not require the use of a listing in a proforma thus obviating mistakes by the surgeon and the always present danger of damaging or splitting the femur during the impaction technique.

According to the present invention apparatus for impacting bone chips in a bone canal comprises an impactor having an impaction head of predetermined dimensions and a stem extending therefrom, and a visual indicator provided with means for secure location on said stem to visually indicate the distance of insertion of said impaction head within the bone canal.

Thus, with this apparatus the impactor is first inserted into the bone canal until the impactor head engages or is close to the inner wall thereof. The visual indicator is then securely located on the stem at a pred termined marked position at the proximal end of the bone. When the bone chips are implanted the impactor head can be driven down compressing the chips until the visual indicator is level with the marking at the proximal end of the bone. This therefore ensures that the impactor is not driven too far down the canal with the likelihood of damage to the bone.

Preferably the visual indicator comprises a clip with means for securing it in position on the stem. It will be appreciated that the clip must be secure so that it does not dislodge during the impaction technique.

Thus, when a surgeon has to impact bone chips into, for example, the intramedullary canal of a femur a bone plug is first inserted and an impactor which is one size small than the intramedullary plug is passed down the canal and a clip applied, the position of the clip in relation to the proximal end of the canal being marked on the canal appropriately. A series of impactors of different sizes are then passed down the canal, the position of their contact with the canal wall being noted and a clip applied at the appropriate point in relation to the marking.

The surgeon is now armed with a set of impactors which are marked as to the depth to which they should be driven without causing damage and the bone chips are then driven down appropriately using the visual indicator to show when the appropriate impactor has been driven to its safe limit.

The invention therefore also includes a method of impacting bone chips in a bone canal which includes inserting an impactor having a stem and an impaction head of predetermined dimensions into a bone canal until the external surface of the impaction head is close to or engages the internal wall of said canal, determining a position at the proximal end of the canal, securely locating a visual indicator on the stem of said impactor to indicate the distance of said impaction head from said determined position, loading said canal with bone chips and impacting said chips with the impaction head until the visual indicator reaches the determined position.

Also included with the invention is a set of parts for impacting bone chips into a bone canal which includes two or more impactors and visual indicators as set forth above and in which the head of each impactor is of different dimensions to the other or others.

The invention can be performed in various ways and a number of embodiments will now be described by way of example and with reference to the accompanying drawings in which :

Figure 1 is a diagrammatic side view of a femur in section showing the positions of five different impactors in the intramedullary canal;

Figure 2 is a diagrammatic side elevation showing the positions of five impactors incorporating the

present invention in their operative positions in an intramedullary canal and connected to an impaction hammer;

Figur 3 is a perspective side levation of part of a first construction of an impactor for use in the invention;

Figure 4 is an end view of a visual indicator for use with the impactor shown in Figure 3;

Figure 5 is a cross sectional end elevation of the visual indicator shown in Figure 4;

Figure 6 is a cross sectional plan view of the visual indicator shown in Figures 4 and 5;

Figure 7 is a plan view of a metal X-ray for use in the visual indicator;

Figure 8 is an isometric diagrammatic view of a pair of spreader pliers for use in attaching the indicator to the impactor;

Figure 9 is a perspective side elevation of part of a second construction according to the invention;

Figure 10 is a cross-sectional plan view of the visual indicator for use with the construction shown in Figure 9;

Figure 11 is a perspective side view of a third construction;

Figure 12 is a perspective side view of a fourth construction; and,

Figure 13 is a perspective side view of a fifth construction.

As described above a series of impactors can be used to compress bone chippings in the intramedullary canal of, for example, a femur which is to receive the stem of a prosthesis. Figure 1 shows a femur 1 having a tapered intramedullary canal 2. A bone plug 3 is shown in position and the positions of five impactors are indicated by reference numerals 4, 5, 6, 7 and 8. It will be seen that as the diameter of the canal increases towards its proximal end it is necessary to have impactors with heads 9, 10, 11, 12 and 13 of increasing diameter in order to compress bone chippings which are applied to the canal above the bone plug 3.

It is essential that the impactor heads are not overdriven into the intramedullary canal 2 otherwise this would cause splitting or damage.

Figur 2 shows the present invention and how it is operated. Each impactor has a stem 15 and a head 4 to 8 as indicated in Figure 1. Each of th stems 15 has attachment means 16 to secure it to an impaction tool 17 which carries a slap hamm r 18. A guide wire, not shown in Figure 1, extends from the bone plug 3 through a suitable bore in the impactor and into the impactor tool 17 where it is visible through a window 20. The guide wire can carry markings which will give another visual indication of the depth of movement of the impactor in relation to the bone plug as the impactor moves down the wire and the bone chippings are compressed.

The upper part of each of the stems 15 carries a series of parallel circumferential grooves (not shown in Figures 1 and 2) onto which a visual indicator provided by a clip 21 can be securely located on the stem. The details of the construction of the impactor stem and the visual indicator are more clearly shown and discussed in Figures 3 to 7.

In order to use the invention the surgeon first inserts the bone plug 3 and selects an impactor 4 which is one size smaller than the bone plug 3. He first inscribes a line marker 22 on the bone and he then fixes the position for the first impactor head 4 and attaches the visual indicator clip 21 to the position shown on the left hand side of Figure 2. The surgeon then passes the next size impactor head down the canal until the head is close to or engages the walls thereof and attaches a clip 21 to the stem, repeating the process with impactors having the heads 6, 7 and 8. The surgeon now has a set of impactors which can be safely used by driving them down until the visual indicator is level with the marking 22.

The bone chips, indicated by reference numeral 23, are now sequentially placed and rammed into position by the series of impactors. In Figure 2 the guide wire is shown by reference numeral 24.

Figure 3 shows a compactor according to the invention which comprises an impaction head 30, a stem 31 and has a bore 32 to receive a guide wire. The upper end of the stem has a configuration 33 for attachment to an impactor device, for example of the kind shown in Figure 2, and the other part of the stem carries a series of parallel circumferential grooves 34.

The visual indicator device according to the invention in this embodiment is in the form of a clip 40 which is made up from a plastics material, for example polypropylene, open ring 41, the outer circumference of which carries a groove 42. The inner circumference of the clip is provided with a protruding engagement flange 43 and the diameter across the inner wall at the position of the flange 43 is such that the clip is a push fit onto the stem 31 when the flange 43 enters one of the grooves 34. The clip body 41 is surrounded by a metal X-ray marker 44, as shown in Figure 7, and the inturned ends 45 of the member engage in angled lined bores 46 so that the marker is retained in position. The width across the mouth of the open ring, indicated by reference numeral A is slightly less than the diameter B of the circular portion of the inner wall so that even without the marker 44 the plastic portion 41 is a push fit onto the stem and the push fit is too tight for the clip to be r mov d man-

ually onc it has be n put in position on the stem.

In an alternative construction (not shown) the clip 40 can be made from a nylon material or other plastics which can been injection moulded and which incorporates a radio opaque material within the moulding. Thus the marker 44 is not required.

Figure 8 shows a typical pair of pliers which can be used to engage the ends of the opening in the open clip to pull it apart to assist in locating it in position and/or removal from the stem.

Figures 9 and 10 show a second construction of the invention in which the same reference numerals are used to indicate similar parts to those shown in Figures 1 to 8.

In this arrangement the stem 31 of the compactor is provided with a continuous series of dimples 50 which extend along its length and only some of which are shown. The dimples are intended to co-operate with a clip 51 which is of substantially the same shape as the clip 40 in the earlier embodiment but does not include the metal X-ray marker 44. This clip is made from a plastics material which has been injection moulded and which incorporates a radio opaque material. The clip 51 carries a locking screw 52 located in a threaded opening 53. With this arrangement the clip can be located at any of the longitudinally extending positions provided by the dimples 50 by tightening the screw 52. This visual indicator works in a similar manner to that described in the previous embodiment.

Figure 11 shows another alternative construction in which once again the same reference numerals are used to indicate similar parts on the impaction stem 31 but in this arrangement a series of spaced apart openings 60 are provided and which are dimensioned to receive a pin 61 which has a head 62 and a drop end link 63. In order to mark the required position it is merely necessary to push the pin through the desired opening 60 and the drop end 63 will ensure that it cannot be inadvertently removed.

Figure 12 shows yet another construction in which a longitudinally extending dovetail slot 70 is provided and which is shaped to receive a dovetail ended marker 71. The inner end 72 of the marker is shaped to slide in the slot in a longitudinal direction but so that it cannot be removed radially and it can be located in any longitudinal position on the pin 31 by screwing in a lock screw 73 which passes through the marker and engages the inner surface of the slot 70.

Figure 13 shows another alternative construction in which the rod 31 is provided with a screw thread on which is located a rotatable nut 81. Thus the nut can be moved up and down the screw thread by rotation and a suitable thread or dimensions of the threads on the nut and stem are arranged so that the nut does not turn freely. Thus it can be moved up and down the rod but will remain in position to indicate a desired position. If desired two nuts could be provided, on acting as a lock nut.

It will be appr ciated that the invention provid s a considerable advantage over known systems because the visual indicator provides an easy identification of the depth of the impactor when it is in use and, moreover, once the visual indicator has been set on the stem of a particular impactor during the first inspection it will not come loose during the impaction process and can be readily seen by the surgeon.

Claims

1. Apparatus for impacting bone chips in a bone canal comprising an impactor having an impaction head of predetermined dimensions and a stem extending therefrom, and a visual indicator provided with means for secure location on said stem to visually indicate the distance of insertion of said impaction head within a bone canal.

2. Apparatus as claimed in claim 1 in which said visual indicator comprises a clip with means for securing it in position on the stem.

3. Apparatus as claimed in claim 2 in which said clip is adapted to engage one of a series of grooves provided in said stem.

4. Apparatus as claimed in claim 2 or claim 3 in which said clip is a push fit onto said stem and is too tight to be manually removed.

5. Apparatus as claimed in claim 2 in which said clip is secured by a screw locating in a series of openings in said stem.

6. Apparatus as claimed in claim 1 in which said visual indicator is provided by a pin adapted to locate in a series of openings in said stem.

7. Apparatus as claimed in claim 1 in which said visual indicator is provided by a slide which can be locked into a track provided on said stem.

8. Apparatus as claimed in claim 1 in which said visual indicator is a screw threaded member located on a screw thread carried on said stem.

9. A set of parts for impacting bone chips into a bone canal including two or more impactors and visual indicators as claimed in any one of the preceding claims and in which the head of each impactor is of different dimensions to the other or others.

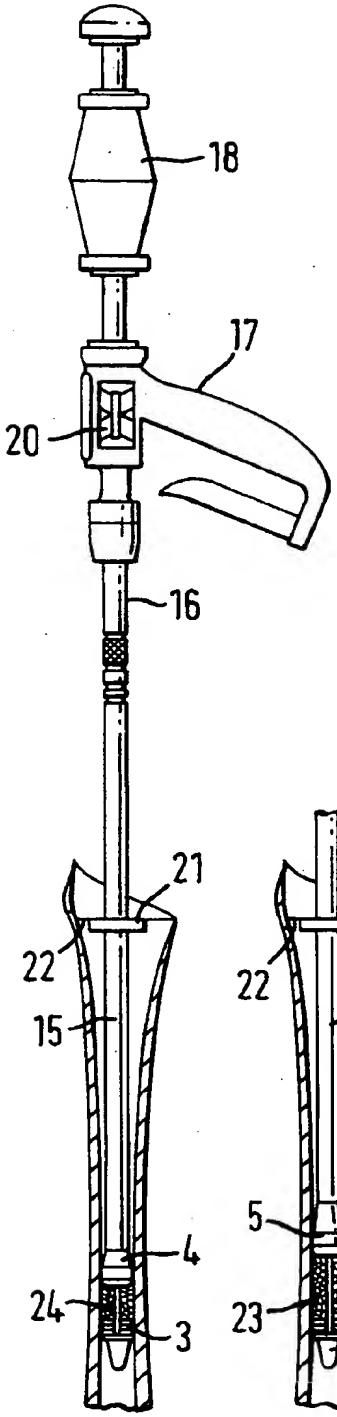
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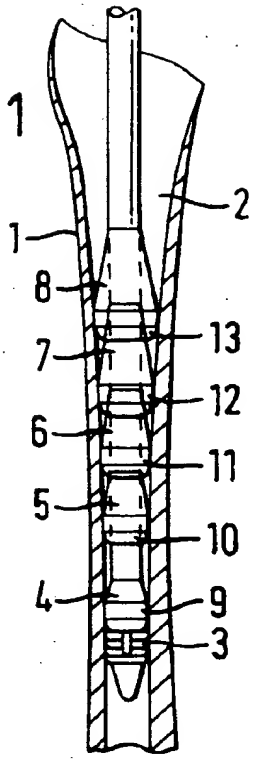
FIG. 1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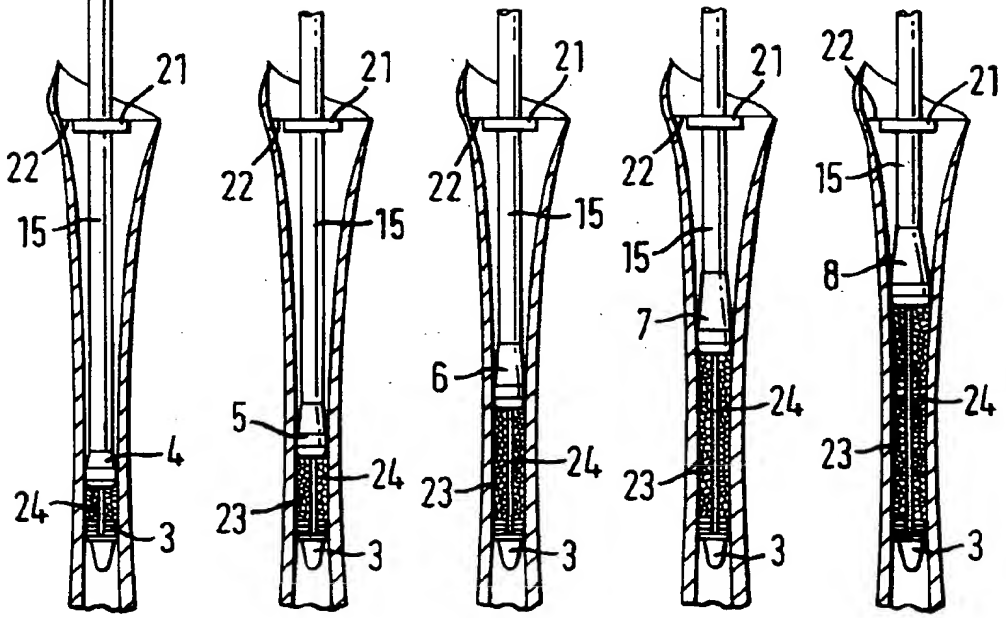
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FIG. 2

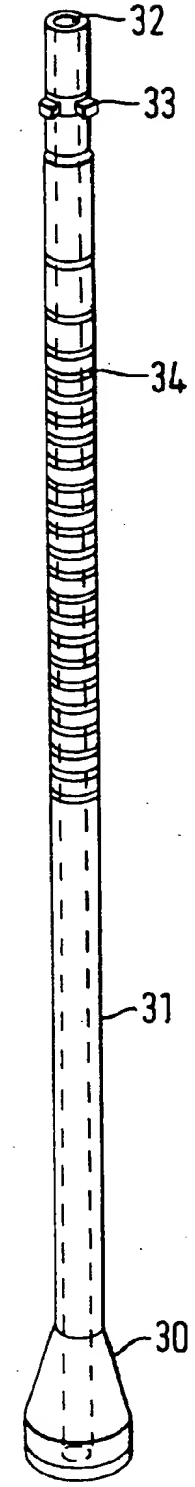

FIG. 3

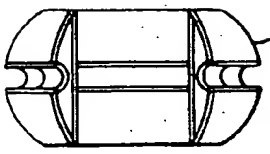

FIG. 4

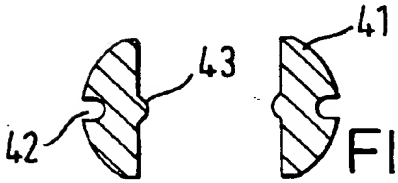

FIG. 5

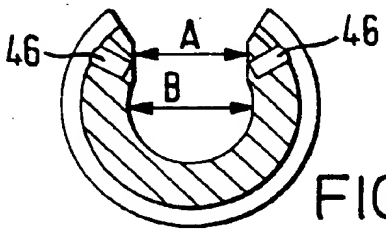

FIG. 6

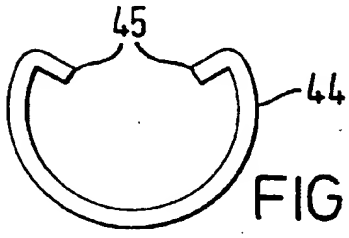

FIG. 7

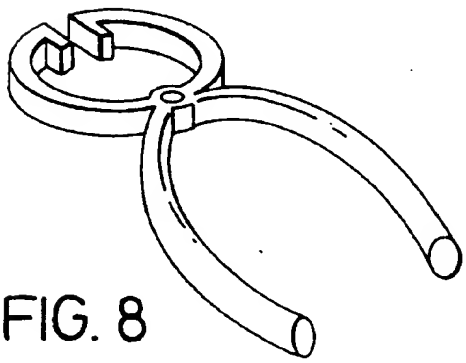

FIG. 8

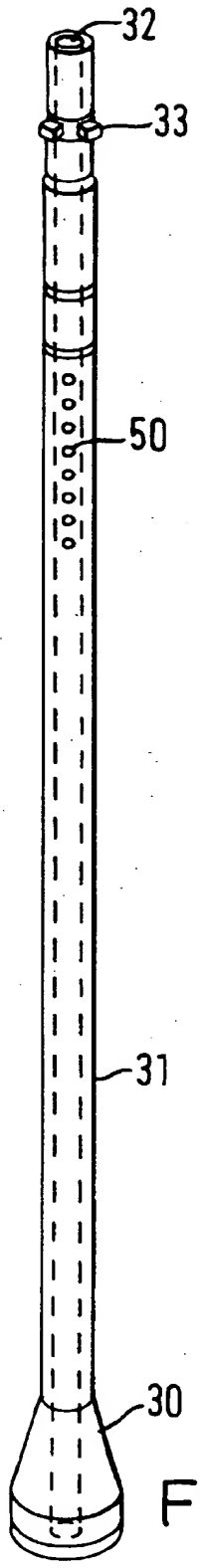

FIG. 9

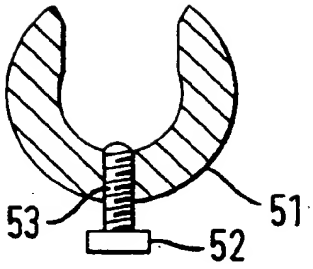

FIG. 10

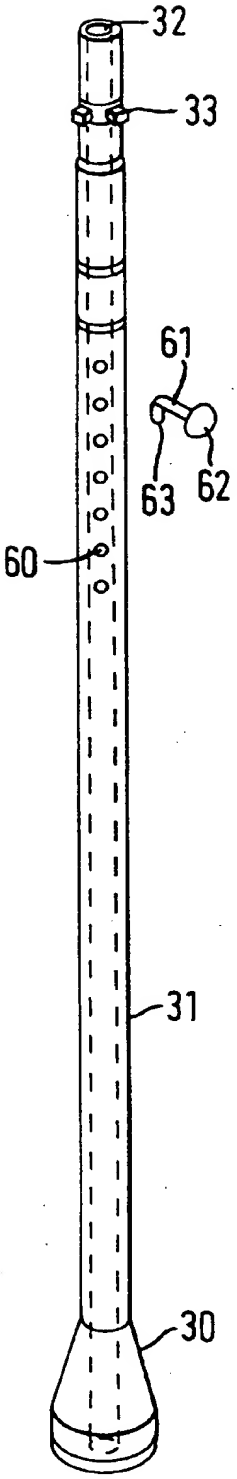

FIG. 11

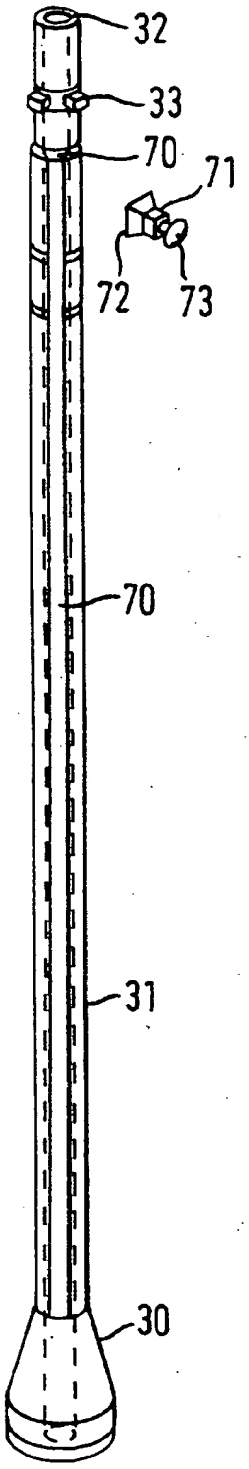

FIG. 12

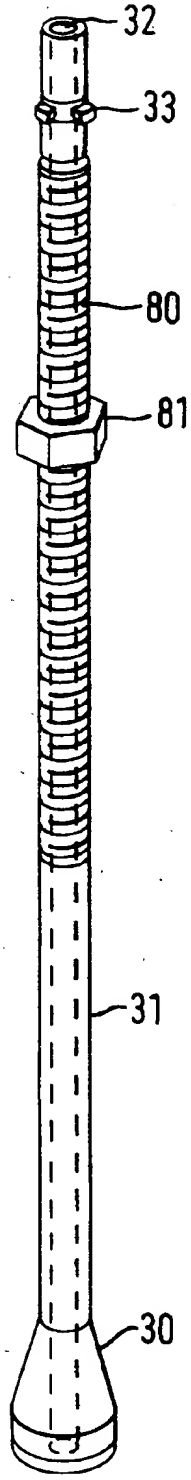

FIG. 13